IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Rice et al.**	§	
	§	Group Art Unit: **2613**
Serial No. **10/668,818**	§	
	§	Examiner: **Bello, Agustin**
Filed: **September 22, 2003**	§	
	§	
For: **High Speed Large Core Multimode Fiber Optic Transmission System and Method Therefore**	§ §	

63759

PATENT TRADEMARK OFFICE
CUSTOMER NUMBER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF (37 C.F.R. 41.37)

This brief is in furtherance of the Notice of Appeal, filed in this case on January 16, 2008.

A fee of $510.00 is required for filing an Appeal Brief. Please charge this fee to Yee & Associates Deposit Account No. 50-3157.

No additional fees are believed to be necessary. If, however, any additional fees are required, I authorize the Commissioner to charge any such fees to Yee & Associates Deposit Account No. 50-3157 .

REAL PARTY IN INTEREST

The real party in interest in this appeal is the following party: The Boeing Company

RELATED APPEALS AND INTERFERENCES

This appeal has no related proceedings or interferences.

STATUS OF CLAIMS

A. TOTAL NUMBER OF CLAIMS IN APPLICATION

The claims in the application are: 21-37

B. STATUS OF ALL THE CLAIMS IN APPLICATION

Claims canceled: 1-20

Claims withdrawn from consideration but not canceled: None

Claims pending: 21-37

Claims allowed: None

Claims rejected: 21-37

Claims objected to: None

C. CLAIMS ON APPEAL

The claims on appeal are: 21-37

STATUS OF AMENDMENTS

No amendments were filed after the Final Office Action of November 14, 2007.

SUMMARY OF CLAIMED SUBJECT MATTER

A. CLAIM 21 - INDEPENDENT

Claim 21 is directed to a system for transmitting data at a data rate of at least 10 gigabits per second by preferentially launching input power into a large core multimode fiber optic cable (LCMFOC) to increase a length/data rate product of the LCMFOC, the system comprising:

a light source for transmitting data from a source as a first light signal, wherein the first light signal comprises a sequence of short light pulses at a data rate of at least 10 gigabytes per second;

a lens having a focal length (f), placed in a path of said first light signal at a distance of approximately said focal length (f) from an end of said LCMFOC, wherein the lens is located to receive said first light signal from said light source and to collimate and focus said short light pulses onto the end of the LCMFOC such that a diameter of focused short light pulses is approximately equal to a core diameter of the LCMFOC to excite low fiber modes and minimize excitation of higher order fiber modes in the LCMFOC,

wherein the LCMFOC is designed to decrease higher order fiber modes which increase pulse spreading that limit the length/data rate product and to thereby increase a transmission distance through the LCMFOC and output second light pulses which include substantially only lower order fiber modes, wherein the LCMFOC comprises:

an exposed core having the core diameter which receives the focused short light pulses; and

a selected doped cladding layer around said exposed core which is selected to excite low order fiber modes of the LCMFOC as said focused short light pulses propagate down the LCMFOC and to absorptively attenuate higher order fiber modes generated in said LCMFOC as said focused short light pulses propagate down the LCMFOC, such that: said focused short light pulses propagate through the LCMFOC with reduced short pulse spreading effects that limit a length/data rate product of said LCMFOC.

B. CLAIM 26 - INDEPENDENT

Claim 26 is directed to a method for transmitting data over a large core multimode fiber optic cable (LCMFOC) at a data rate of at least 10 gigabits per second, the method comprising the steps of:

providing a selected large core multimode fiber optic cable (LCMFOC), wherein the selected LCMFOC comprises: a doped cladding layer around an exposed core having a core diameter, wherein the doped cladding layer is selected to excite low order fiber modes of the selected LCMFOC and to absorptively attenuate higher order fiber modes of the selected LCMFOC which contribute to pulse spreading to increase a transmission distance through the selected LCMFOC; and

providing a source of short light pulses;

providing a lens of a focal length (f);

placing said lens in a path of between the source and the selected LCMFOC at a distance of approximately the focal length (f) from the source; and

transmitting data from said source as a sequence of short light pulses at a data rate of at least 10 gigabytes per second;

focusing the sequence of short light pulses with said lens to collimate and focus said short light pulses onto an end of the exposed core of the selected LCMFOC such that a diameter of focused short light pulses is approximately equal to the core diameter to produce a focused sequence of short light pulses to preferentially launch input power into said selected LCMFOC to excite low fiber modes and minimize excitation of higher order fiber modes in the selected LCMFOC to increase a length/data rate product of said selected LCMFOC,

wherein the doped cladding layer:

excites low order fiber modes as said focused short light pulses propagate down the selected LCMFOC; and

attenuates higher order fiber modes as said focused short light pulses propagate down the selected LCMFOC so that said focused short light pulses propagate through the selected LCMFOC with reduced short pulse spreading effects that limit the length/data rate product of said selected LCMFOC, such that second light pulses output by said selected LCMFOC include substantially only lower order modes.

C. CLAIM 31 - INDEPENDENT

The subject matter of claim 31 is directed to a communication system for high speed data transmission comprising:

a light source for transmitting data as a first light signal;

a lens having a focal length f for receiving said first light signal from said light source, said lens being approximately said focal length f from said exposed core of said large core multimode fiber optic cable,

a large core multimode fiber optic cable, comprising:

an exposed core having a core diameter, wherein a refractive index of said exposed core is substantially real to propagate said light signal with low loss, wherein a second light signal received from said lens at the exposed core is focused on and has a diameter approximately equal to said core diameter to reduce excitation of higher order modes; and

a doped cladding layer around said exposed core of said large core multimode fiber optic cable that attenuates higher order modes generated in said large core multimode fiber optic cable to reduce pulse spreading effects that limit a length/data rate product, and

wherein said refractive index of said doped cladding layer includes a complex component that attenuates higher order modes such that a third light signal output by said large core multimode fiber optic cable includes substantially only lower order modes.

D. CLAIM 33 - INDEPENDENT

The subject matter of claim 33 is directed to a method for increasing a length/data rate product for a large core multimode step index fiber optic cable comprising a doped cladding layer around an exposed core of said large core multimode fiber optic cable, wherein the exposed core has a core diameter and wherein the doped cladding layer absorptively attenuates of higher order modes, the method comprising the steps of:

providing a data transmission comprising a sequence of light pulses;

focusing said light pulses onto an exposed end of a core of the large core step index multimode fiber optic cable such that a diameter of a light pulse is approximately equal to the core diameter to minimize excitation of higher order modes in the large core multimode step index fiber optic cable; and

using the doped cladding layer to attenuate higher order modes of said light pulses as said data transmission propagates down the large core multimode step index fiber optic cable to reduce pulse spreading effects that limit a length/data rate product such that second light pulses output by said large core multimode step index fiber optic cable includes substantially only lower order modes.

E. CLAIM 34 - INDEPENDENT

The subject matter of claim 34 is directed to a communication system for high speed data transmission, comprising:

a light source for transmitting data; and

a lens having a focal length f for receiving light from said light source; and

a large core multimode fiber optic cable comprising a core and a doped cladding layer around said core, wherein said lens being approximately said focal length f from an exposed core of said large core multimode fiber optic cable, and wherein a light signal from said lens is focused on and has a diameter approximately equal to a core diameter of said large core multimode fiber optic cable to reduce excitation of higher order modes, and wherein said doped cladding layer is designed to absorb higher order modes to reduce pulse spreading effects that limit said length/data rate product.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The grounds of rejection to review on appeal are as follows:

A. GROUND OF REJECTION 1

Whether the Examiner failed to state a *prima facie* obviousness rejection under 35 U.S.C. § 103 against claims 21, 22, 25-28, 31-35, and 37 in view of *Numata, et al.*, Optical Transmission System, U.S. Patent Application Publication 2002/0105704 (August 8, 2002) (hereinafter "*Numata*") in view of *Siegman*, Fiber Lasers Having a Complex-Valued Vc-Parameter for Gain-Guiding, U.S. Patent 6,751,388 (June 15, 2004) (hereinafter "*Siegman*") in view of *Aoki*, Optical Transmitter and Optical Signal Transmitter, U.S. Patent 6,757,499 (June 29, 2004) (hereinafter "*Aoki*").

B. GROUND OF REJECTION 2

Whether the Examiner failed to state a *prima facie* obviousness rejection under 35 U.S.C. § 103 against claims 23 and 29 in view of *Numata*, *Siegman*, *Aoki*, and *Edvold, et al.*, Method and Apparatus for Providing Dispersion Compensation, U.S. Patent 6,724,956 (April 20, 2004) (hereinafter "*Edvold*").

C. GROUND OF REJECTION 3

Whether the Examiner failed to state a *prima facie* obviousness rejection under 35 U.S.C. § 103 against claims 24 and 30 in view of *Numata*, *Siegman*, *Aoki*, and *White*, Use of Mode Coupled Optical Fiber in Communications Systems, U.S. Patent 6,476,951 (November 5, 2002) (hereinafter "*White*").

D. GROUND OF REJECTION 4

Whether the Examiner failed to state a *prima facie* obviousness rejection under 35 U.S.C. § 103 against claim 36 in view of *Numata*, *Siegman*, *Aoki*, *Edvold* and *White*.

ARGUMENT

A. GROUND OF REJECTION 1

The Examiner failed to state a *prima facie* obviousness rejection under 35 U.S.C. § 103 against claims 21, 22, 25, 28, 31-35, and 37 in view of *Numata* in view of *Siegman* in view of *Aoki*.

A.1. Claims 21, 22, and 25-28

Applicants first address claims 21, 22, and 25-28. Claim 21 is a representative claim of this grouping of claims. Claim 21 is as follows:

> 21. A system for transmitting data at a data rate of at least 10 gigabits per second by preferentially launching input power into a large core multimode fiber optic cable (LCMFOC) to increase a length/data rate product of the LCMFOC, the system comprising:
>
> a light source for transmitting data from a source as a first light signal, wherein the first light signal comprises a sequence of short light pulses at a data rate of at least 10 gigabytes per second;
>
> a lens having a focal length (f), placed in a path of said first light signal at a distance of approximately said focal length (f) from an end of said LCMFOC, wherein the lens is located to receive said first light signal from said light source and to collimate and focus said short light pulses onto the end of the LCMFOC such that a diameter of focused short light pulses is approximately equal to a core diameter of the LCMFOC to excite low fiber modes and minimize excitation of higher order fiber modes in the LCMFOC,
>
> wherein the LCMFOC is designed to decrease higher order fiber modes which increase pulse spreading that limit the length/data rate product and to thereby increase a transmission distance through the LCMFOC and output second light pulses which include substantially only lower order fiber modes, wherein the LCMFOC comprises:
>
> > an exposed core having the core diameter which receives the focused short light pulses; and
> >
> > a selected doped cladding layer around said exposed core which is selected to excite low order fiber modes of the LCMFOC as said focused short light pulses propagate down the LCMFOC and to absorptively attenuate higher order fiber modes generated in said LCMFOC as said focused short light pulses propagate down the LCMFOC, such that: said focused short light pulses propagate through the LCMFOC with reduced short pulse spreading effects that limit a length/data rate product of said LCMFOC.

In rejecting claim 21, the Examiner stats that:

Regarding claims 21, 26, 31, 33, 34, and 37, Numata teaches a light source (reference numeral III in Figure 1) for transmitting data from a source as a first light signal, wherein the first light signal comprises a sequence of short light pulses (paragraph [0008]); a lens (reference numeral 112 in Figure 1) having a focal length, placed in a path of said first light signal at a distance of approximately said focal length from an end of said LCMFOC (reference letter Z1 in Figure 2), wherein the lens is located to receive said first light signal from said light source and to collimate and focus said short light pulses onto the end of the LCMFOC such that a diameter of focused short light pulses is approximately equal to a core diameter of the LCMFOC to excite low fiber modes and minimize excitation of higher order fiber modes in the LCMFOC (paragraphs [0051], [0055] , wherein the LCMFOC is designed to decrease higher order fiber modes (paragraph [0051]; Figure 9) which increase pulse spreading that limit the length/data rate product and to thereby increase a-transmission distance through the LCMFOC and output second light pulses which include substantially only lower order fiber modes, wherein the LCMFOC comprises: an exposed core having the core diameter which receives the focused short light pulses (inherent in Figures 1 & 2). Numata differs from the claimed invention in that Numata fails to disclose two aspects of the claimed invention.

First, Numata fails to specifically teach using a step index fiber optic cable having a doped cladding layer for absorptive attenuation of higher order modes. However, Siegman, from the same field of endeavor discloses the use of a step index fiber optic cable having a doped cladding layer for absorptive attenuation of higher order modes (column 1 lines 36-47; column 3 lines 47-58; column 7 lines 60-61; column 11 lines 50-54; e.g. "index-antiguiding" throughout). One skilled in the art would have been motivated to employ a step index fiber optic cable having a doped cladding layer for absorptive attenuation of higher order modes in order to reduce the amount of mode mixing and randomizing of propagating modes to reduce dispersion (column 7 lines 1-15 of Siegman). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to use a step index fiber optic cable having a doped cladding layer for absorptive attenuation of higher order modes as taught by Siegman in the device of Numata.

Second, Numata fails to specifically teach that said light source transmits data at greater than 10 gigabits per second. However, Aoki teaches that this concept is well known in the art and common (column 1 lines 45-50). One skilled in the art would have been motivated to include a transmitter with the ability to transmit at greater than 10 gigabits in order to transfer a large amount of information in a short period of time. Therefore, it would have been obvious to one skilled in the art at the time the invention was made to include a light source that transmits data at greater than 10 gigabits per second.

Final Office Action of November 14, 2007, pp. 2-3.

The Examiner bears the burden of establishing a *prima facie* case of obviousness based on prior art when rejecting claims under 35 U.S.C. § 103. *In re Fritch*, 972 F.2d 1260, 23 U.S.P.Q.2d 1780 (Fed. Cir. 1992). The prior art reference (or references when combined) must teach or suggest all the claim limitations. *In re Royka,* 490 F.2d 981, 180 USPQ 580 (CCPA 1974). In determining obviousness, the scope and content of the prior art are... determined; differences between the prior art and the claims at issue are... ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or non-obviousness of the subject matter is determined. *Graham v. John Deere Co.*, 383 U.S. 1 (1966). "Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR Int'l. Co. v. Teleflex, Inc.*, No. 04-1350 (U.S. Apr. 30, 2007). "*Rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.* Id. (citing *In re Kahn*, 441 F.3d 977, 988 (CA Fed. 2006))."

A.1.i The Proposed Combination Does Not Teach a System Having a Lens Placed at the Claimed Focal Length Distance

Under the standards of *In re Royka*, the Examiner failed to state a *prima facie* obviousness rejection against claim 21 because the combination, considered as a whole, fails to teach or suggest the claimed feature of, "a lens having a focal length (f), placed in a path of said first light signal at a distance of approximately said focal length (f) from an end of said LCMFOC, wherein the lens is located to receive said first light signal from said light source and to collimate and focus said short light pulses onto the end of the LCMFOC such that a diameter of focused short light pulses is approximately equal to a core diameter of the LCMFOC to excite low fiber modes and minimize excitation of higher order fiber modes in the LCMFOC." The Examiner asserts otherwise, citing Figure 2 of *Numata*, as well as paragraphs 0051 and 0055 of *Numata*. However, *Numata* explicitly contracts the Examiner's assertions.

Again, claim 1 requires that the lens be placed at a distance of approximately the focal length of the lens from the end of the cable. *Numata* ***explicitly*** contradicts the Examiner on this point:

> [0036] In FIG. 1, the MMF 12 is a glass fiber of a graded index type, a polymer cladding fiber, or a plastic optical fiber. As shown in FIG. 2, the MMF 12 includes a core 121 and a cladding 122. A connector plug 123 is affixed to one end of the MMF 12 around the outer periphery thereof. The connector plug 123 is fitted into the receptacle 113 of the transmitter 11. As a result, as shown in FIG. 2, the fiber axis A.sub.fr of the MMF 12 and the optical axis A.sub.lz of the lens 112 are aligned with each other, and one of the end faces of the core 121 (hereinafter referred to as an "input plane F.sub.in") is positioned at a predetermined distance Z.sub.1 from the vertex Z.sub.0 of the lens 112 along the fiber axis A.sub.fr. *The distance* ***Z.sub.1*** *is set at a value which is* ***not equal*** *to the distance from the vertex* ***Z.sub.0*** *to the focal point* ***Z.sub.fp****, and preferably set at a value greater than the distance from the vertex Z.sub.0 to the focal point Z.sub.fp.*

Numata, paragraph 0036 (emphasis supplied).

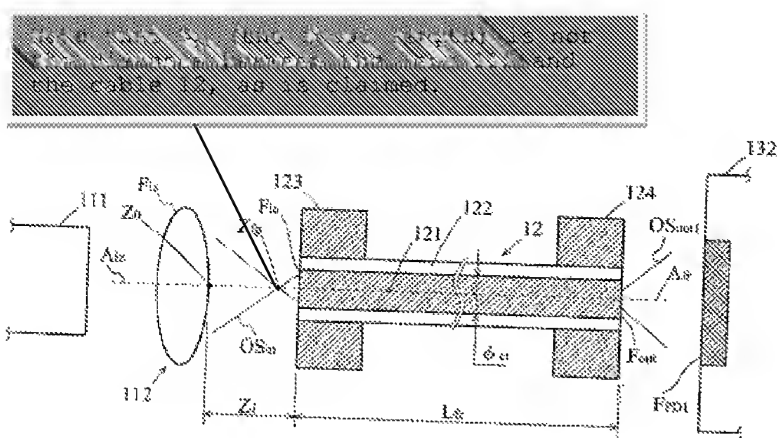


FIG.2

Figure 2 of *Numata* shows that the focal point (Z_{fp}) of lens 112 is not at a distance of approximately the focal length (Z_{fp}) of the lens from the end of the cable 12. In fact, not only does Figure 2 show this fact, but *Numata* explicitly provides that the distance (Z_1) between the lens 112 and the cable 12 is not equal to the distance between the lens 112 (shown as Z_0) and the focal point Z_{fp}. The Examiner's assertion is manifestly contrary to the plain disclosures of *Numata*; hence, the Examiner is plainly wrong.

The Examiner's assertions regarding paragraphs 0051 and 0055 are also plainly wrong. Paragraph 0051 is as follows:

> [0051] Usually, the above-defined NA.sub.f is determined by the refractive indices of the core 12 and the cladding 122, and is a parameter which is independent of the aforementioned NA.sub.s. If light having a numerical

> aperture greater than the NA.sub.f enters the input plane F.sub.in, any components which spread outside the aforementioned range of propagation angles of the MMF 12 will be transmitted through to the exterior of the MMF 12. On the other hand, if the optical signal OS.sub.in has a numerical aperture smaller than the NA.sub.f, then all components of the light will propagate through the core 12 as explained above. Moreover, since the optical signal OS.sub.in has a smaller numerical aperture than the NA.sub.f in this case, the higher-order modes in the optical signal OS.sub.in are decreased, so that the mode dispersion can be reduced.

Numata, paragraph 0051.

This text is irrelevant to the question of the distance between the lens and the cable. Claim 1 requires that distance to be approximately equal to the focal length. The above-quoted text describes the effect of the *numerical aperture* (NA) of the cable and of the light source. *Numata* provides that the numerical aperture of the cable (NA.sub.f) describes the only components which propagate to the output plane F.sub.out. *Numata*, paragraph 0051. The numerical aperture of the cable is determined by the refractive indices of the *core* and the *cladding* of the cable; thus, the numerical aperture of the cable is only associated with the cable. Plainly, this value has nothing to do with the distance between the lens and the cable.

The numerical aperture of the light source is NA.sub.s. In paragraph 0048 *Numata* defines this value to be equal to the sine of the angle alpha, shown in Figure 5. In this context, consider the other irrelevant portion of *Numata* cited by the Examiner:

> [0055] First, the case in which the NA.sub.s is equal to or less than the NA.sub.f will be considered. In this case, all of the components of the optical signal OS.sub.in which have passed through the lens 112 and which enters the core 12 are propagated to the output plane F.sub.out. If S(Z.sub.1) is equal to or greater than S.sub.f, NA.sub.in (Z.sub.1) decreases as Z.sub.1 increases, as expressed by equation (4) below: 1 NA in (Z 1) = sin th = sin ((arctan (cr 2 | Z 1 - Z fp |))) ; S (Z 1) S f (4)

Numata, paragraph 0055.

Numata is comparing various ratios of the numerical aperture of the source and the numerical aperture of the cable. In paragraph 0055, *Numata* considers the case where the ratio is about equal, or NA.sub.s is about equal to or less than NA.sub.f. However, given the definitions of these values, *Numata* is plainly not discussing the distance between the lens and the cable at all. In fact, this portion of *Numata* is utterly irrelevant to claim 1.

Still further, *Numata* does not teach that the lens focuses the light from the source onto the end of the cable such that the diameter of focused light is approximately equal to the core diameter. As shown in Figure 2 and Figure 5 of *Numata*, the Examiner's assertions to the contrary are manifestly wrong. This fact is further proved with respect to A.3.i. of this brief.

As shown above, *Numata* explicitly contradicts the Examiner's assertions that *Numata* teaches the claimed feature of, "a lens having a focal length (f), placed in a path of said first light signal at a distance of approximately said focal length (f) from an end of said LCMFOC, wherein the lens is located to receive said first light signal from said light source and to collimate and focus said short light pulses onto the end of the LCMFOC such that a diameter of focused short light pulses is approximately equal to a core diameter of the LCMFOC to excite low fiber modes and minimize excitation of higher order fiber modes in the LCMFOC." For this reason, *Numata* does not teach or suggest this claimed feature.

Additionally, neither *Siegman* nor *Aoki* teach or suggest this claimed feature, and the Examiner does not assert otherwise. Still further, neither *Edvold* nor *White* teach or suggest this claimed feature. Therefore, no combination of the cited references, considered as a whole, teaches or suggests this claimed feature. Therefore, under the standards of *In re Royka*, the Examiner failed to state a *prima facie* obviousness rejection against claim 21 or any other claim in this grouping of claims.

A.1.ii. *Numata* Teaches Away from the Claimed Invention

In addition, the Examiner has failed to establish a *prima facie* obviousness rejection against claim 21 because *Numata* directly teaches away from the invention of claim 21. Thus, no reason exists to achieve the legal conclusion that claim 21 is obvious in view of the references considered as a whole, as required by *KSR Intl.*

A reference may be said to "teach away" from the claimed invention when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. *In re Gurley*, 27 F.3d 551, 553, 31 U.S.P.Q.2D 1130, 1131 (Fed. Cir. 1995).

In this case, *Numata* discloses that the influence of mode dispersion is reduced ***because*** *the focal length of the lens is less than the distance between the lens and the cable*. *Numata*, Abstract,

penultimate sentence. In direct contrast, claim 21 requires that the distance between the lens and the cable be at the focal length of the lens. Specifically, claim 21 requires, "*a lens having a focal length (f), placed* in a path of said first light signal *at a distance of approximately said focal length (f) from an end of said LCMFOC.*"

One of ordinary skill, upon reading *Numata* would believe that the claimed invention *would not work* because *Numata* teaches that the resulting decrease in mode dispersion is achieved by placing the lens at a location where the focal length is less than the distance between the lens and the cable. Thus, one of ordinary skill would be led in a direction divergent from the path that was taken by Applicants.

Accordingly, under *In re Gurley, Numata* teaches away from claim 21. For this reason, no rational underpinning exists to achieve the legal conclusion of obviousness under *KSR Intl.* Accordingly, the Examiner failed to state a *prima facie* obviousness rejection against claim 21 or any other claim in this grouping of claims.

A.1.iii. *Aoki* Does Not Teach what the Examiner Asserts *Aoki* To Teach Vis-à-Vis Claim 21

The Examiner cites *Aoki* for the proposition that transmission rates of 10 gigabits per second are well known. Final Office Action of November 14, 2007, p. 3. However, at least vis-à-vis claim 21, the Examiner is again plainly wrong because the Examiner fails to recognize the differences between normal optical fibers and large core multimode fiber optic cables.

Aoki teaches that the typical transmission speed in a long-distance main line system is currently 2.5 gigabits per second to 10 gigabits per second. *Aoki*, col. 1, ll. 45-46 (also cited by the Examiner). However, the Examiner ignored the portion of *Aoki* that states that such speeds are obtained in <u>*main line systems*</u>. These systems are not large core multimode fiber optic cables, as claimed.

Large core multimode fiber optic cables are not main line optical systems. For example, Applicants' specification provides as follows:

> Another type of fiber optic cable is a large core multimode cable. The large core multimode cable typically has a core size on the order of or greater than 50 microns. Common sizes for a large core multimode cable are 50, 62.5, and 100 micron diameters. In general, the preferred light source for transmission in a large core multimode cable is 850 and 1300 nanometers. As its name implies, large core multimode cable allows light waves to be dispersed into numerous paths or modes that travel down the cable core.

> *The multiple modes travel at different phase velocities and hence produce waveform distortion and noise at the receiving end. The distortion becomes a significant issue for greater distances, and thus multimode cable has been found not to be suitable for long distance applications.* ***<u>The multiple modes also reduce the speed at which data can be transmitted.</u>***

Applicants' Specification, paragraph 0005 (emphasis supplied).

The specification goes on to state that:

> Large core multimode fiber optic cable is an alternative to single mode fiber optic cable for low to midrange distances. Currently, large core multimode fiber optic cables are performance limited in length/data rate product. This will be discussed in more detail hereinbelow. In general, a core diameter of a large core multimode fiber optic cable is greater than 50 microns whereas a single mode core is typically 10 microns or less. ***<u>In conventional systems, an upper limit for the data transfer rate of a large core multimode fiber optic cable is in the range of 1-10 gigabit per second</u>*** and it is useful for applications less than 1000 meters in length without repeaters that regenerate the signal. The wavelength of light used for data transmission in a large core multimode fiber optic cable is typically greater than 750 nanometers.

Applicants' Specification, paragraph 0016 (emphasis supplied).

Aoki teaches that in *<u>main line systems</u>* data rates between 2.5 and 10 Gb/s (gigabits) can be obtained. Applicants' specification is in concurrence with this teaching. However, the Examiner fails to realize that in the claimed large core multimode cable, such data transmission rates *are limited to this speed.* Thus, the Examiner's citation to *Aoki* is misplaced.

In fact, *Aoki* does not teach the claimed feature of, "wherein the first light signal comprises a sequence of short light pulses at a data rate of at least 10 *<u>gigabytes</u>* per second." Note that the term "gigabyte" is used, an amount which is greater than a "gigabit." Therefore, the claimed range is outside the range taught by *Aoki*, even if *Aoki* had any relevance to large core multimode cables, as claimed. In fact, *Aoki* is irrelevant to claim 21, because *Aoki* contains no teachings regarding large core multimode cables, as in claim 21.

The Examiner admits that *Numata* does not teach or suggest this claimed feature. Additionally, *Siegman* does not teach this claimed feature, and the Examiner does not assert otherwise. Still further, neither *White* nor *Edvold* teach or suggest this claimed feature. As shown above, *Aoki* does not teach or suggest this claimed feature and, even if *Aoki* did suggest this claimed feature, the citation to *Aoki* is misplaced. Hence, the combination of references, considered as a

whole, does not teach or suggest this claimed feature. Therefore, under the standards of *In re Royka*, the Examiner failed to state a *prima facie* obviousness rejection against claim 21 or any other claim in this grouping of claims.

A.1.iv. The Examiner Used Impermissible Hindsight when Fashioning the Rejection

The Examiner failed to state a *prima facie* obviousness rejection against claim 21 because the Examiner used impermissible hindsight when fashioning the rejection. "It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." *In re Hedges*, 228 U.S.P.Q. 685, 687 (Fed. Cir. 1986). Additionally, Personal opinion cannot be substituted for what the prior art teaches because a prima facie case of obviousness is established when the teachings of the prior art itself suggest the claimed subject matter to a person of ordinary skill in the art. *In re Bell*, 991 F.2d 781, 783, 26 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1993).

In the case at hand, *Numata* explicitly contradicts the Examiner's assertions. Additionally, as shown above, the Examiner misapplied the teachings of *Aoki* vis-à-vis claim 21. Thus, the *only* way that the Examiner could have combined the references is to have attempted to pick and choose elements from the art and then combined the references using Applicants' specification as a template. Under *In re Hedges* and *In re Bell*, this action constitutes impermissible hindsight. Therefore, the Examiner failed to state a *prima facie* obviousness rejection against claim 21 or any other claim in this grouping of claims.

A.1.v. No Rational Underpinning Exists To Achieve the Legal Conclusion of Obviousness

Additionally, no rational underpinning exists to achieve the legal conclusion of obviousness of claim 21, as required by *KSR Intl.* Given that *Numata* explicitly contradicts claim 21 and given that *Aoki* is irrelevant to claim 21, no rational underpinning can exist to achieve the legal conclusion that claim 21 is obvious in view of the combination of references considered as a whole. Accordingly, under *KSR Intl.*, the Examiner failed to state a *prima facie* obviousness rejection against claim 21 or any other claim in this grouping of claims.

A.2. Claims 31 and 32

Applicants next address the rejection of claims 31 and 32. Claim 31 is a representative claim of this grouping of claims. Claim 31 is as follows:

> 31. A communication system for high speed data transmission comprising:
>
> a light source for transmitting data as a first light signal;
>
> a lens having a focal length f for receiving said first light signal from said light source, said lens being approximately said focal length f from said exposed core of said large core multimode fiber optic cable,
>
> a large core multimode fiber optic cable, comprising:
>
> an exposed core having a core diameter, wherein a refractive index of said exposed core is substantially real to propagate said light signal with low loss, wherein a second light signal received from said lens at the exposed core is focused on and has a diameter approximately equal to said core diameter to reduce excitation of higher order modes; and
>
> a doped cladding layer around said exposed core of said large core multimode fiber optic cable that attenuates higher order modes generated in said large core multimode fiber optic cable to reduce pulse spreading effects that limit a length/data rate product, and
>
> wherein said refractive index of said doped cladding layer includes a complex component that attenuates higher order modes such that a third light signal output by said large core multimode fiber optic cable includes substantially only lower order modes.

A.2.i. The Proposed Combination, Considered as a Whole, Does Not Teach or Suggest All of the Features of Claim 31.

As shown above, the Examiner incorrectly cites *Numata* for teaching the claimed feature of, "a lens having a focal length f for receiving said first light signal from said light source, said lens being approximately said focal length f from said exposed core of said large core multimode fiber optic cable." In fact, *Numata* expressly contradicts the Examiner's assertion in this regard.

In addition, the Examiner ignores the feature in claim 31 that, "a refractive index of said exposed core is substantially real." The combination *Numata*, *Siegman*, and *Aoki*, considered as a whole, does not teach or suggest this claimed feature. *Numata* and *Aoki* are utterly devoid of disclosure in this regard. Ironically, *Siegman* directly teaches away from the claimed invention regarding this claimed feature that the Examiner ignores. Regarding the real/imaginary components of the index of refraction of the fiber core, *Siegman* teaches that:

> The invention also provides a method for designing an optical fiber with a complex-valued V.sub.C -parameter. In accordance with the method the core and cladding surrounding the core are defined. *The optical fiber is doped with the active dopant such as active ions of Nd, Yb, Er or others to produce a certain doping profile. The doping profile establishes a gain g inside the optical fiber that makes a sufficiently large contribution to the imaginary part of the complex-valued V.sub.C -parameter to define at least one gain-guided mode of radiation within the fiber.* The method of the invention can be extended to further defining an index profile that establishes index-guiding or index-antiguiding. It is also possible to use no index effects at all. When working with step profiles, i.e., when the index exhibits a step index profile and the dopant exhibits a step dopant profile it is convenient to approximate the complex-valued said complex-valued V.sup.C -parameter as: [equation omitted].
>
> where a is the core radius, .DELTA.n is the index difference between the core and cladding, and .lambda. is the free space wavelength of the radiation. As noted above, it is convenient to consider instead the square of the complex-valued V.sub.C -parameter: [equation omitted].
>
> since it is then apparent that the index difference .DELTA.n is entirely responsible for the real part of the square of the complex-valued V.sub.C -parameter, *while the gain profile g is entirely associated with the imaginary part of the square of the V.sub.C -parameter*. Further details of the invention are explained in the below detailed description with reference to the attached drawing figures.

Siegman, col. 4, l. 60 through col. 5, l. 30 (emphasis supplied).

Siegman teaches that the index of refraction of the core of the fiber should have an *imaginary* component. Id. In fact, *Siegman* teaches that the imaginary index of refraction is what allows for the high gain of the fiber, Id., and thus is critical to the disclosure of *Siegman*.

Thus, *Siegman* does not teach or suggest that, "a refractive index of said exposed core is substantially real," as in claim 31. Given that none of the other references teach or suggest this claimed feature, the combination of references, considered as a whole, does not teach or suggest this claimed feature. Therefore, under the standards of *In re Royka*, the Examiner failed to state a *prima facie* obviousness rejection against claim 31 or any other claim in this grouping of claims.

A.2.ii. No Rational Underpinning Exists to Achieve the Legal Conclusion of Obviousness in View of the Cited References

Additionally, no rational underpinning exists to achieve the legal conclusion of obviousness of claim 31, as required by *KSR Intl.* As shown above, *Siegman* explicitly teaches that the core of the fiber should have an index of refraction with an imaginary component. This teaching directly conflicts with the required feature that," a refractive index of said exposed core is substantially real," as in claim 31. Because the teachings of *Siegman* conflict with claim 31, in further view that *Numata* and *Aoki* contain no teachings in this regard, no rational underpinning exists to achieve the legal conclusion that claim 31 is obvious in view of the claimed references. Accordingly, under *KSR Intl.*, the Examiner failed to state a *prima facie* obviousness rejection against claim 31 or any other claim in this grouping of claims.

Still further, *Numata* also teaches away from the invention of claim 31 for the reasons presented above. Given that *both Numata* and *Siegman* teach away from the claimed invention, no rational underpinning exists to achieve the legal conclusion of obviousness, as required by *KSR Intl.* Accordingly, again, the Examiner failed to state a *prima facie* obviousness rejection against claim 31 or any other claim in this grouping of claims.

A.3. Claim 33

Applicants next address the rejection of claim 33. Claim 33 is as follows:

> 33. A method for increasing a length/data rate product for a large core multimode step index fiber optic cable comprising a doped cladding layer around an exposed core of said large core multimode fiber optic cable, wherein the exposed core has a core diameter and wherein the doped cladding layer absorptively attenuates of higher order modes, the method comprising the steps of:
>
> providing a data transmission comprising a sequence of light pulses;
>
> focusing said light pulses onto an exposed end of a core of the large core step index multimode fiber optic cable such that a diameter of a light pulse is approximately equal to the core diameter to minimize excitation of higher order modes in the large core multimode step index fiber optic cable; and
>
> using the doped cladding layer to attenuate higher order modes of said light pulses as said data transmission propagates down the large core multimode step index fiber optic cable to reduce pulse spreading effects that limit a length/data rate product such that second light pulses output by said

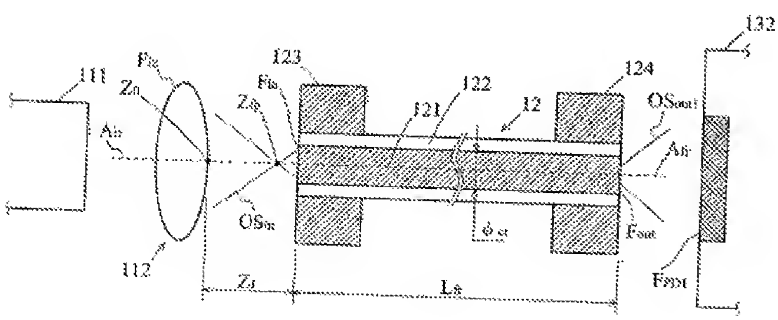
large core multimode step index fiber optic cable includes substantially only lower order modes.

A.3.i. The Proposed Combination, Considered as a Whole, Does Not Teach or Suggest All of the Features of Claim 33.

The Examiner failed to state a *prima facie* obviousness rejection against claim 33 because the proposed combination, considered as a whole, does not teach or suggest all of the features of claim 31. Specifically, the proposed combination does not teach, "focusing said light pulses onto an exposed end of a core of the large core step index multimode fiber optic cable such that a diameter of a light pulse is approximately equal to the core diameter to minimize excitation of higher order modes in the large core multimode step index fiber optic cable." The Examiner relies on *Numata* as teaching this claimed feature, as neither *Aoki* nor *Siegman* teach or suggest this claimed feature.

Numata does not explicitly teach or suggest anything regarding this claimed feature in words, but does suggest otherwise in the figures. The Examiner asserts otherwise, point to paragraphs 0051 and 0055 of *Numata*. However, as shown above, these paragraphs are *irrelevant* to this claimed feature because these paragraphs deal with the defined numerical aperture ratios. In fact, as shown in Figure 2 and Figure 5 of *Numata*, the light does not have the same diameter as the core, as claimed.

FIG. 2



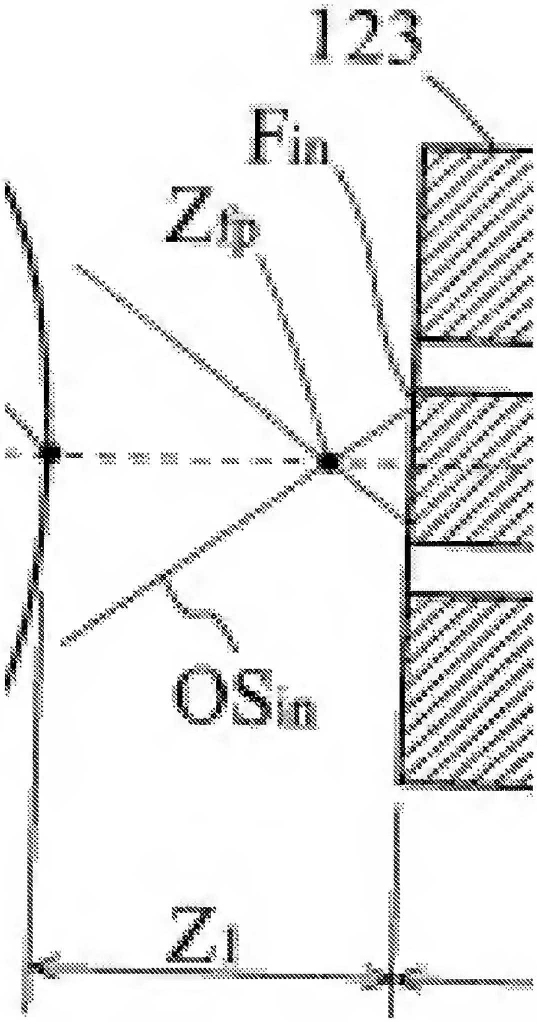
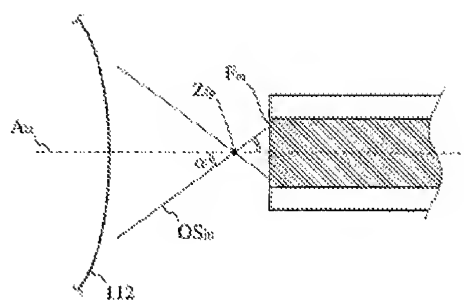


FIG.5



As shown in the blow-up of Figure 2 and also as shown in Figure 5, the diverging light rays from the focal point do not intersect the core. Instead, the light diverges to points that correspond to a distance less than the diameter of the core. Thus, *Numata* appears to contradict the Examiner's assertion that *Numata* teaches, "focusing said light pulses onto an exposed end of a core of the large core step index multimode fiber optic cable such that a diameter of a light pulse is approximately equal to the core diameter to minimize excitation of higher order modes in the large core multimode step index fiber optic cable," as in claim 33.

Siegman and *Aoki* do not teach or suggest this claimed feature. As shown above, *Numata* does not teach this claimed feature, but rather suggests the opposite of this claimed feature.

Therefore, under the standards of *In re Royka*, the Examiner failed to state a *prima facie* obviousness rejection against claim 33.

A.3.ii. No Rational Underpinning Exists to Achieve the Legal Conclusion of Obviousness in View of the Cited References

As shown above, *Numata* and *Siegman* are contrary to the claimed invention. *Aoki* is irrelevant to the claimed invention. As a result, no rational underpinning exists to achieve the legal conclusion of obviousness of claim 33, as required by *KSR Intl.* Accordingly, the Examiner failed to state a *prima facie* obviousness rejection against claim 33.

A.4. Claims 34, 35, and 37

Applicants next address the rejection of claims 34, 35, and 37. Claim 34 is a representative claim of this grouping of claims. Claim 34 is as follows:

> 34. A communication system for high speed data transmission, comprising:
> a light source for transmitting data; and
> a lens having a focal length f for receiving light from said light source; and
> a large core multimode fiber optic cable comprising a core and a doped cladding layer around said core, wherein said lens being approximately said focal length f from an exposed core of said large core multimode fiber optic cable, and wherein a light signal from said lens is focused on and has a diameter approximately equal to a core diameter of said large core multimode fiber optic cable to reduce excitation of higher order modes, and wherein said doped cladding layer is designed to absorb higher order modes to reduce pulse spreading effects that limit said length/data rate product.

Claim 34 requires, "wherein said lens being approximately said focal length f from an exposed core of said large core multimode fiber optic cable." As shown above, *Numata* expressly teaches away from this claimed feature and expressly contradicts the Examiner's assertions in this regard.

Claim 34 also requires, "a light signal from said lens is focused on and has a diameter approximately equal to a core diameter of said large core multimode fiber optic cable." As shown above, *Numata* teaches away from this claimed feature and contradicts the Examiner's assertions in this regard.

Therefore, for the reasons given above, the combination of references does not teach or suggest all of the features of claim 34. Similarly, no rational underpinning exists to achieve the legal conclusion of obviousness of claim 34, as required by *KSR Intl.* Therefore, the Examiner failed to state a *prima facie* obviousness rejection against claim 34 or any other claim in this grouping of claims.

B. GROUND OF REJECTION 2

The Examiner failed to state a *prima facie* obviousness rejection under 35 U.S.C. § 103 against claims 23 and 29 in view of *Numata*, *Siegman*, *Aoki*, and *Edvold*. Claim 23 is a representative claim of this grouping of claims. Claim 23 is as follows:

> 23. The system as recited in claim 21, wherein said first light signal has a wavelength greater than 750 nanometers.

In rejecting claim 23, the Examiner states that:

> Regarding claims 23 and 29, the combination ofNumata, Siegman, and Aoki differs from the claimed invention in that it fails to specifically teach that said light source provides light having a wavelength greater than 750 nanometers. However, Edvold teaches that the industry standard for transmitting light on fiber is 1550 nm with wavelengths typically in the 1530 to 1565 nm range (column 1 lines 28-44). One skilled in the art would have been motivated to transmit a wavelength at greater than 750 nanometers in an optical system due to favorable signal loss and dispersive properties at these wavelengths (Edvold column 1 lines 27-44). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to transmit a wavelength at greater than 750 nanometers in the optical system of the combination of references.

Final Office Action of November 14, 2007, pp. 4-5.

Claim 23 depends on claim 21. As shown above, *Numata* expressly teaches away from claim 21 and expressly contradicts the Examiner's assertions regarding claim 21. *Siegman* also expressly teaches away from claim 21 and implicitly contradicts the Examiner's assertions regarding claim 21. *Aoki* is irrelevant, as *Aoki* does not contain disclosures relevant to claim 21. *Edvold* is also irrelevant, as *Edvold* does not contain disclosures related to the focal length of a lens or the real/complex portions of an index of refraction of an optical cable. Instead, *Edvold* is cited merely for the proposition that the industry standard for transmitting light is 1550 nm.

In view of the fact that *Numata* and *Siegman* are contrary to claim 21 and that *Aoki* and *Edvold* are irrelevant to claim 21, the proposed combination, considered as a whole, does not teach or suggest all of the features of claim 23 – which depends on claim 21. Accordingly, the Examiner failed to state a *prima facie* obviousness rejection against claim 23 or any other claim in this grouping of claims.

C. GROUND OF REJECTION 3

The Examiner failed to state a *prima facie* obviousness rejection under 35 U.S.C. § 103 against claims 24 and 30 in view of *Numata*, *Siegman*, *Aoki*, and *White*. Claim 24 is a representative claim of this grouping of claims. Claim 24 is as follows:

> 24. The system as recited in claim 21, wherein a signal level from said light source is launched to said selected LCMFOC at 20dBM or more.

In rejecting claim 24, the Examiner states that:

> Regarding claims 24 and 30, the combination of references as applied to claims 21 and 26 differs from the claimed invention in that it fails to specifically discuss or disclose launching power to said LCMFOC at 20dBM or more. However, White teaches that this concept is well known in the art (column 7 lines lO-19). One skilled in the art would have been motivated to launch an optical signal at 20 dBm or more in order to compensate for the known attenuation of the signal by the fiber. Therefore, it would have been obvious to one skilled in the art at the time the invention was made to launch an optical signal at 20 dBm or greater in the device of the combination of references.

Final Office Action of November 14, 2007, p. 5.

Claim 24 depends on claim 21. As shown above, *Numata* expressly teaches away from claim 21 and expressly contradicts the Examiner's assertions regarding claim 21. *Siegman* also expressly teaches away from claim 21 and implicitly contradicts the Examiner's assertions regarding claim 21. *Aoki* is irrelevant, as *Aoki* does not contain disclosures relevant to claim 21. *White* is also irrelevant, as *White* does not contain disclosures related to the focal length of a lens or the real/complex portions of an index of refraction of an optical cable. Instead, *White* is cited merely for the proposition that launching power to the cable at 20dBM or more is known.

In view of the fact that *Numata* and *Siegman* are contrary to claim 21 and that *Aoki* and *White* are irrelevant to claim 21, the proposed combination, considered as a whole, does not teach

or suggest all of the features of claim 24 – which depends on claim 21. Accordingly, the Examiner failed to state a *prima facie* obviousness rejection against claim 24 or any other claim in this grouping of claims.

D. GROUND OF REJECTION 4

The Examiner failed to state a *prima facie* obviousness rejection under 35 U.S.C. § 103 against claim 36 in view of *Numata*, *Siegman*, *Aoki*, *Edvold* and *White*.

> As noted above in the rejection of claims 23-24 and 29-30, the combination ofNumata, Siegman, and Aoki obviates the transmission of data at a rate greater than 10 Gbps. However, the combination ofreferences differs from the claimed invention in that it fails to specifically teach that the launch power is greater than 20dBm or that wavelengths greater than 750 nm are used.
>
> However, Edvold teaches that the industry standard for transmitting light on fiber is 1550 nm with wavelengths typically in the 1530 to 1565 nm range (column 1 lines 28-44). One skilled in the art would have been motivated to transmit a wavelength at greater than 750 nanometers in an optical system due to favorable signal loss and dispersive properties at these wavelengths (Edvold column 1 lines 27-44). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to transmit a wavelength at greater than 750 nanometers in the optical system of the combination of references.
>
> Furthermore, White teaches that launch power greater than 20dBm (column 7 lines 10- 19) is well known in the art. One skilled in the art would have been motivated to launch an optical signal at 20 dBm or more in order to compensate for the known attenuation of the signal by the fiber. Therefore, it would have been obvious to one skilled in the art at the time the invention was made to launch an optical signal at 20 dBm or greater in the device of the combination of references.

Final Office Action of November 14, 2007, pp. 5-6.

Claim 36 depends on claim 34. In view of the fact that *Numata* and *Siegman* are contrary to claim 34 and that *Aoki*, *Edvold*, and *White* are irrelevant to claim 34, the proposed combination, considered as a whole, does not teach or suggest all of the features of claim 36 – which depends on claim 34. Accordingly, the Examiner failed to state a *prima facie* obviousness rejection against claim 36.

E. CONCLUSION

As shown above, the Examiner has failed to state valid rejections against any of the claims. Therefore, Applicants request that the Board of Patent Appeals and Interferences reverse the rejections. Additionally, Applicants request that the Board direct the Examiner to allow the claims.

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CLAIMS APPENDIX

The text of the claims involved in the appeal is as follows:

21. A system for transmitting data at a data rate of at least 10 gigabits per second by preferentially launching input power into a large core multimode fiber optic cable (LCMFOC) to increase a length/data rate product of the LCMFOC, the system comprising:

a light source for transmitting data from a source as a first light signal, wherein the first light signal comprises a sequence of short light pulses at a data rate of at least 10 gigabytes per second;

a lens having a focal length (f), placed in a path of said first light signal at a distance of approximately said focal length (f) from an end of said LCMFOC, wherein the lens is located to receive said first light signal from said light source and to collimate and focus said short light pulses onto the end of the LCMFOC such that a diameter of focused short light pulses is approximately equal to a core diameter of the LCMFOC to excite low fiber modes and minimize excitation of higher order fiber modes in the LCMFOC,

wherein the LCMFOC is designed to decrease higher order fiber modes which increase pulse spreading that limit the length/data rate product and to thereby increase a transmission distance through the LCMFOC and output second light pulses which include substantially only lower order fiber modes, wherein the LCMFOC comprises:

an exposed core having the core diameter which receives the focused short light pulses; and

a selected doped cladding layer around said exposed core which is selected to excite low order fiber modes of the LCMFOC as said focused short light pulses propagate down the LCMFOC and to absorptively attenuate higher order fiber modes generated in said

LCMFOC as said focused short light pulses propagate down the LCMFOC, such that: said focused short light pulses propagate through the LCMFOC with reduced short pulse spreading effects that limit a length/data rate product of said LCMFOC.

22. The system for high speed data transmission as recited in claim 21, wherein said lens collimates said first light signal to reduce an excitation of higher order modes generated in said LCMFOC.

23. The system as recited in claim 21, wherein said first light signal has a wavelength greater than 750 nanometers.

24. The system as recited in claim 21, wherein a signal level from said light source is launched to said selected LCMFOC at 20dBM or more.

25. The system as recited in claim 21 further including:
a receiver coupled to an opposing end of said LCMFOC for receiving said second light pulses.

26. A method for transmitting data over a large core multimode fiber optic cable (LCMFOC) at a data rate of at least 10 gigabits per second, the method comprising the steps of:

providing a selected large core multimode fiber optic cable (LCMFOC), wherein the selected LCMFOC comprises: a doped cladding layer around an exposed core having a core diameter, wherein the doped cladding layer is selected to excite low order fiber modes of the selected LCMFOC and to absorptively attenuate higher order fiber modes of the selected LCMFOC

which contribute to pulse spreading to increase a transmission distance through the selected LCMFOC; and

providing a source of short light pulses;

providing a lens of a focal length (f);

placing said lens in a path of between the source and the selected LCMFOC at a distance of approximately the focal length (f) from the source; and

transmitting data from said source as a sequence of short light pulses at a data rate of at least 10 gigabytes per second;

focusing the sequence of short light pulses with said lens to collimate and focus said short light pulses onto an end of the exposed core of the selected LCMFOC such that a diameter of focused short light pulses is approximately equal to the core diameter to produce a focused sequence of short light pulses to preferentially launch input power into said selected LCMFOC to excite low fiber modes and minimize excitation of higher order fiber modes in the selected LCMFOC to increase a length/data rate product of said selected LCMFOC,

wherein the doped cladding layer:

excites low order fiber modes as said focused short light pulses propagate down the selected LCMFOC; and

attenuates higher order fiber modes as said focused short light pulses propagate down the selected LCMFOC so that said focused short light pulses propagate through the selected LCMFOC with reduced short pulse spreading effects that limit the length/data rate product of said selected LCMFOC, such that second light pulses output by said selected LCMFOC include substantially only lower order modes.

27. The method as recited in claim 26, wherein the core diameter is greater than or equal to 50 microns.

28. The method as recited in claim 26, wherein said selected LCMFOC comprises: a selected step index LCMFOC.

29. The method as recited in claim 26, wherein said first light signal has a wavelength greater than 750 nanometers.

30. The method as recited in claim 26, wherein a signal level from said light source is launched to said selected LCMFOC at 20dBM or more.

31. A communication system for high speed data transmission comprising:

a light source for transmitting data as a first light signal;

a lens having a focal length f for receiving said first light signal from said light source, said lens being approximately said focal length f from said exposed core of said large core multimode fiber optic cable,

a large core multimode fiber optic cable, comprising:

an exposed core having a core diameter, wherein a refractive index of said exposed core is substantially real to propagate said light signal with low loss, wherein a second light signal received from said lens at the exposed core is focused on and has a diameter approximately equal to said core diameter to reduce excitation of higher order modes; and

a doped cladding layer around said exposed core of said large core multimode fiber optic cable that attenuates higher order modes generated in said large core multimode fiber optic cable to reduce pulse spreading effects that limit a length/data rate product, and

wherein said refractive index of said doped cladding layer includes a complex component that attenuates higher order modes such that a third light signal output by said large core multimode fiber optic cable includes substantially only lower order modes.

32. The system recited in claim 31 wherein said lens collimates said light signal to reduce an excitation of higher order modes generated in said large core multimode fiber optic cable.

33. A method for increasing a length/data rate product for a large core multimode step index fiber optic cable comprising a doped cladding layer around an exposed core of said large core multimode fiber optic cable, wherein the exposed core has a core diameter and wherein the doped cladding layer absorptively attenuates of higher order modes, the method comprising the steps of:

providing a data transmission comprising a sequence of light pulses;

focusing said light pulses onto an exposed end of a core of the large core step index multimode fiber optic cable such that a diameter of a light pulse is approximately equal to the core diameter to minimize excitation of higher order modes in the large core multimode step index fiber optic cable; and

using the doped cladding layer to attenuate higher order modes of said light pulses as said data transmission propagates down the large core multimode step index fiber optic cable to reduce pulse spreading effects that limit a length/data rate product such that second light pulses output by

said large core multimode step index fiber optic cable includes substantially only lower order modes.

34. A communication system for high speed data transmission, comprising:

a light source for transmitting data; and

a lens having a focal length f for receiving light from said light source; and

a large core multimode fiber optic cable comprising a core and a doped cladding layer around said core, wherein said lens being approximately said focal length f from an exposed core of said large core multimode fiber optic cable, and wherein a light signal from said lens is focused on and has a diameter approximately equal to a core diameter of said large core multimode fiber optic cable to reduce excitation of higher order modes, and wherein said doped cladding layer is designed to absorb higher order modes to reduce pulse spreading effects that limit said length/data rate product.

35. The system as recited in claim 34 wherein said lens collimates said light signal to reduce an excitation of higher order modes generated in said large core multimode fiber optic cable.

36. The system as recited in claim 34, wherein a signal level from said light source is launched to said large core multimode fiber optic cable at greater than 20dBM, and wherein said light source provides light having a wave length greater than 750 nanometers and transmits data at greater than 10 gigabits per second.

37. The system as recited in claim 34, wherein a refractive index of said core is substantially real to propagate said light signal with low loss and wherein said refractive index of said doped cladding layer includes a complex component that attenuates higher order modes generated in said large core multimode fiber optic cable.

EVIDENCE APPENDIX

This appeal brief presents no additional evidence.

RELATED PROCEEDINGS APPENDIX

This appeal has no related proceedings.